DACA42-03-C-0024

LOGANEnergy Corp.

Fire Station #1 PEM Demonstration Program
Robins Air Force Base, Warner Robins, Georgia
Midterm Report

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY02

Robins Air Force Base
Warner Robins, Georgia

May 7, 2004

Executive Summary

In October 2001, LOGANEnergy Corporation received a contract award from the US Army Corps of Engineers, Construction Engineering Research Lab to test and evaluate Proton Exchange Membrane (PEM) Fuel Cells at several DOD sites. Robins Air Force Base, Warner Robins, GA was one of the sites awarded to LOGAN. This PEM demonstration site is now operational after the initial start-up occurred on April 24, 2003.

The Robins Fire Station hosts this 5kW Plug Power CHP, PEM fuel cell installation. The fuel cell is a technology demonstration unit manufactured by Plug Power Corporation, Latham, NY. The unit operates in both grid parallel/grid synchronized and grid independent configurations. The system operating set point is 2.5kW for the one-year demonstration test program. The unit is instrumented with an external wattmeter, a gas flow meter, a Btu meter, and an Ultralite data logger. A phone line is connected to the power plant communication's modem to permit it call-out with alarms or events that require service and attention, or to permit a technician to call into the controller to diagnose operating problems.

The Robins Point of Contact is Carl Perazzola who may be reached at (478) 222-1658. At this point in the demonstration project LOGAN forecasts that Robins AFB will pay an annual energy premium of $767.12 to host the project.

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Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

Fire Station #1 PEM Demonstration Program, Robins Air Force Base, Warner Robins, Georgia

2.0 Name, Address and Related Company Information

LOGANEnergy Corporation

1080 Holcomb Bridge Road
BLDG 100- 175
Roswell, GA 30076
(770) 650- 6388

DUNS 01-562-6211
CAGE Code 09QC3
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 7 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 PAFC and PEM fuel cell projects at 21 locations in 12 states, and has agreements to install 22 new projects in the US and the UK over the next 18 months.

3.0 Production Capability of the Manufacturer

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P LP Gas unit, and the GenCor 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Scott Wilshire is the Plug Power point of contact for this project. His phone number is 518.782.7700 ex1338, and his email address is scott_wilshire@plugpower.com.

4.0 Principal Investigator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

5.0 Authorized Negotiator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022

Merck & Company
Ms. Stephanie Chapman
Merck & Company
Bldg 53 Northside
Linden Ave. Gate
Linden, NJ 07036
(732) 594-1686

Contract: Four-year PC25 PM Services Maintenance Agreement.
In November 2002 Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the contract period the power plant has operated at 94% availability. LOGAN performs the quarterly and annual service prescribed by the UTC, and performs other maintenance as required. The periods of unavailability are chiefly due to persistent inverter problems that seem to be endemic to the Toshiba power conditioning balance of the system. Field modifications and operating adjustments have largely cured the problem. Quarterly service events take 10 hours to complete with the unit under load, and the annual event takes approximately 35 hours with the unit shut down.

b) Contract: Plug Power Service and Maintenance Agreement to support one 5kWe GenSys 5C and one 5kWe GenSys 5P PEM power plant at NAS Patuxant River, MD.

Plug Power
Mr. Scott Wilshire.
968 Albany Shaker Rd.
Latham, NY 12110
(518) 782-7700 ex 1338

LOGAN performed the start-up of both units after Southern Maryland Electric Cooperative completed most of the installation work. The units are located at residential sites at Patuxant River Naval Air Station, VA and operate in standard gird connected/grid independent configurations. Both operate at 4.5kWe and have maintained 98% availability. The units, S/Ns 241 and 242 are two of the very latest GenSys models to reach the field. S/N 242 is Plug Power's first LPG fueled system to go into the field. Both have set a new level of performance expectations for this product, and are indicative of the success of the various test and evaluation programs that have been conducted over the past two years.

c) Contract: A Partners LLC Commercial Fuel Cell Project Design, Installation and 5-year service and maintenance agreement.
   Contract # A Partners LLC, 12/31/01

Mr. Ron Allison
A Partners LLC
1171 Fulton Mall
Fresno, CA 93721
(559) 233-3262

On April 20, 2004 LOGAN completed the installation of a 600kWe PC25C CHP fuel cell installation in Fresno, CA. The system operating configurations allow for both grid parallel and grid independent energy service. The grid independent system is integrated with a multi unit load sharing electronics package and static switch, which initial development was funded by ERDC CERL in 1999. This is the third fuel cell installation that uses the MULS System. The thermal recovery package installed in the project includes a 100-ton chiller that captures 210 degree F thermal energy supplied by the three fuel cells to cool the first three floors of the host facility. The fuel cells also provide low-grade waste heat at 140 degrees F that furnishes thermal energy to 98 water source heat pumps located throughout the 12-story building during the winter months.

7.0 Host Facility Information

Warner Robins ALC and Robins AFB, in Warner Robins, Georgia, led by Center Commander Major General Dennis G. Haines, is the state's largest industrial facility employing 5,253 military and over 12,749 civilian employees. Robins is home to over 50 organizations including the Warner Robins ALC, Headquarters Air Force Reserve (HQ AFRC), the 78th Air Base Wing (78ABW), the 19th Air Refueling Group (19ARG) or "Black Knights", 5th Combat Communications Group (5CCG), 93rd Air Control Wing (93ACW) (E-8C Joint STARS), and the 116th Bomb Wing (116BW) of the Air National Guard (B-1B).

Named in honor of Brigadier General Augustine Warner Robins, the Georgia Army Air Depot was dedicated April 26, 1943 outside of Wellston, Georgia, now Warner Robins, Georgia. Initial approval for construction in June of 1941 as part of a long range plan to prepare America's defenses in case of war was hastened by the bombing of Pearl Harbor.

Known as the Georgia Air Depot during the early days, it was re-designated as: the Southeast Air Depot, Wellston Air Depot (WAD), Wellston Army Air Depot, Warner Robins Army Air Depot (WRAAD), Warner Robins Air Depot Control Area Command, Warner Robins Air Service Command (WRASC), and Warner Robins Air Technical Services Command (WRATSC) during World War II.

Georgia Power and the City of Warner Robins are the electricity and natural gas providers for Robins AFB respectively.

8.0 Fuel Cell Installation

After visiting several possible sites, the Robins AFB Fire Station was selected. In mid March 2003, Plug Power shipped GenSys SN#192 fuel cell to Robins. The installation proceeded according to plan with minimal inconvenience to the base or the host site. LOGAN worked closely with the Robins Civil Engineering Environmental Department to insure the installation satisfied all environmental requirements. No permits were required or issued for this site.

The first start occurred on April 24, 2003, requiring a total of 152 man-hours to complete installation and commissioning. The actual cost to install the unit at Robins increased by approximately $4,000 dollars as compared to the projected cost. Since this project was the technician's first CHP installation, it actually required a higher number of man-hours to perform all of the tasks than originally projected.

Almost immediately the unit experienced a number of operational problems largely dealing with inverter software issues. These centered chiefly on the inability of the inverter to distinguish between the grid parallel line and the grid independent loads. Following two weeks of intense troubleshooting and problem analysis, Plug determined that the MP-5 main control chip was not able to read the feedback grid independent load even though it was supplying power to the panel. After replacing the old chip with an upgrade, the power plant started normally and the inverter has preformed satisfactorily. In July of 2003, failure of the fuel cell to call out after a shutdown accounted for most of the lost availability. This issue is discussed in great detail in the Data Acquisition section below, and it should be stated that the problems effecting low availability in the month of July 2003 have largely been corrected. Therefore we anticipate that the operating availability on this unit will increase to acceptable levels.

Figure 1

Figure 2

Figures 1 and 2, above are photos of the fuel cell on its pad at the entrance to the Robins AFB Fire Station, which is centrally located in the Robins community, and where the installation, itself, is very visible to passers-by. The station facility manages and dispatches respondents to fire and other base emergencies, and houses a full kitchen and dorm rooms for the emergency crews. The fuel cell was rigged onto the pad, Figures 1 and 2, with the assistance of a base fork truck. The mechanical room is conveniently located behind the adjacent brick wall to the right of the fuel cell.

Robins AFB PEM Installation Line Diagram

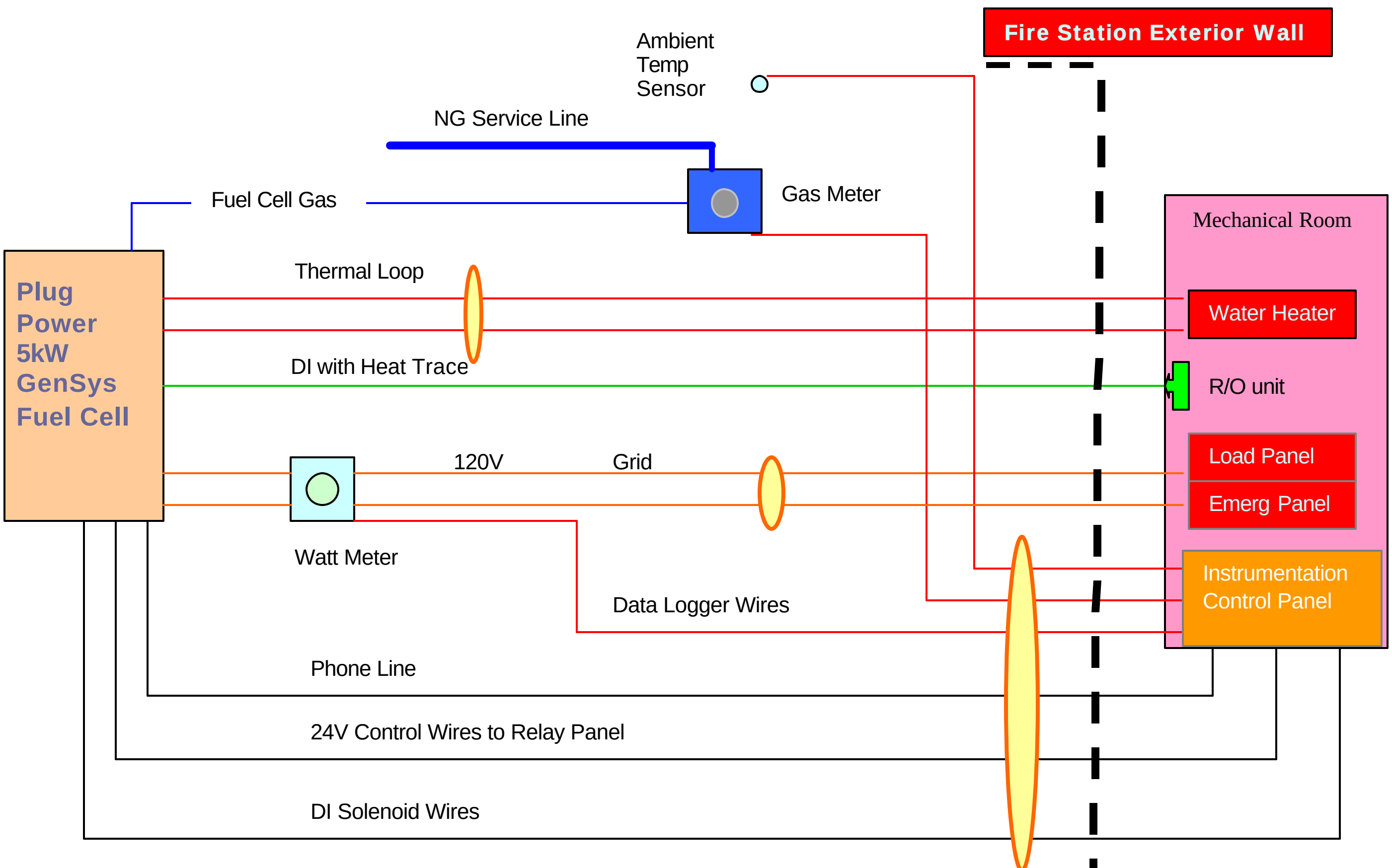


Figure 3

Figure 3, above, describes a one line diagram of the Robins Fire Station fuel cell installation. The diagram illustrates utility and control interfaces including, gas, power, water and instrumentation devices installed in the adjacent mechanical room of the fire station.

The electrical conduit runs between the facility load panels and the fuel cell are approximately 25 feet. The Reverse Osmosis/DI water tubing run that provides filtered process water to the power plant is approximately 15 feet distance, and the thermal recovery piping runs between the fuel cell and the hot water heater are also approximately 15; both may also be seen Figures 5 and 6 page 11.

9.0 Electrical System

The fuel cell inverter has a power output of 110/120 VAC at 60 Hz, matching the building distribution panel in the mechanical room with its connected loads at 110/120 VAC. The installation includes both a grid parallel and a grid independent configuration as indicated in Figure 7. The unit provides stand-by power to a new 100amp critical circuit panel that serves several kitchen appliances and other plug loads. A two-pole wattmeter monitors both the grid parallel and grid independent conductors to record fuel cell power distribution to both the existing panel and the new critical load panel.

Figure 4

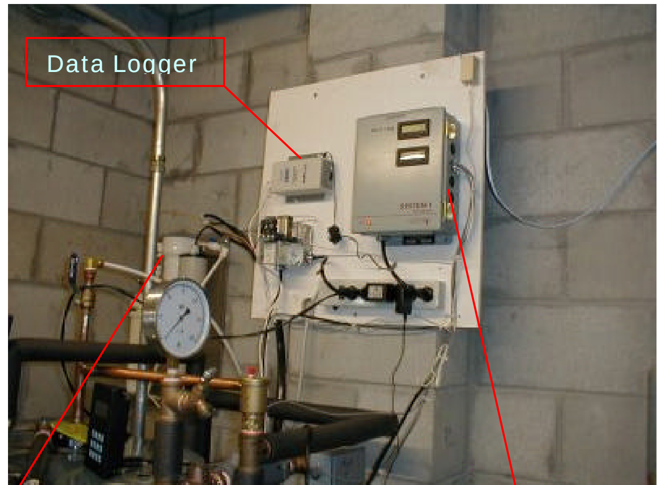
Figure 4, above, is a photo of the unit on its pad showing the electrical interface on the building wall at right. The doorway to the mechanical room can also be seen on the right side of the photo.

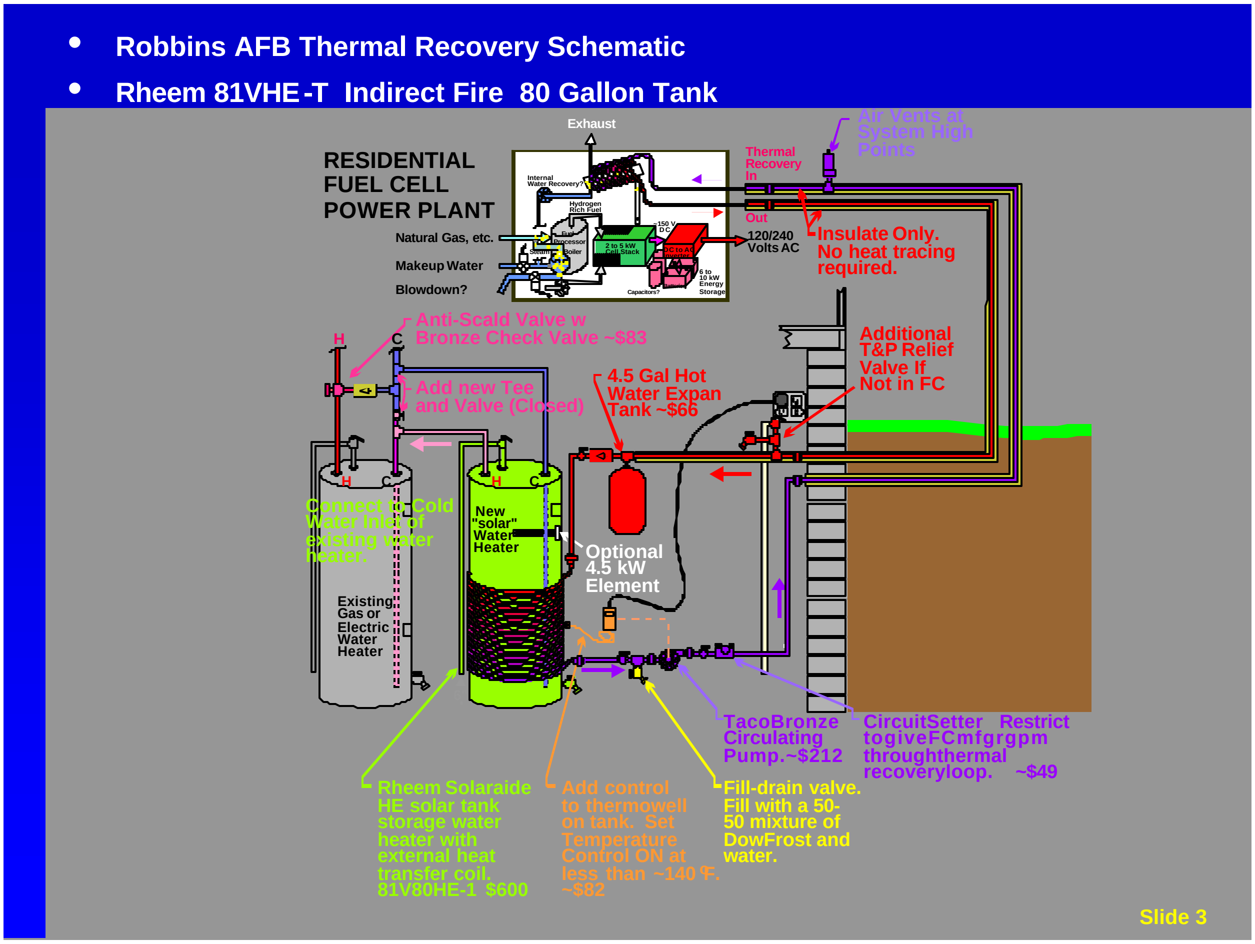
10.0 Thermal Recovery System

LOGAN installed a new Rheem 80-gallon thermal storage tank at the site to demonstrate waste heat recovery from the fuel cell with a domestic appliance. A small pump circulates 140 degree F glycol/water solution between the fuel cell heat exchanger and an external concentric coil designed by Rheem to wrap the exterior or the tank. A separate pump transfers the contents of the Rheem tank to the facility's hot water tank for subsequent distribution through the domestic hot water plumbing. With the fuel cell operating at 2.5kWh, the coil can transfer waste process fuel cell waste heat into the water heater at the rate of 8000 Btuh. Figures 5 and 6, below, are labeled photos of the major components of the thermal recovery system installed at Robins AFB. Figure 7, below, is a schematic drawing of the fully integrated thermal recovery system at Robins. Performance data for this system may be viewed in Appendix 1. Unfortunately information is missing in the months of November 2003 through February 2004 because the data record was unreadable. The technician found loose wire terminal connections and problem has been corrected.

Figure 5

Figure 6





11.0 Data Acquisition System

During the period October 2002 to August 2003, LOGAN's field service technicians performed their tasks with the support of a very rudimentary SCADA system developed by Plug Power for communicating with deployed units. This system provided one-way communication from each unit to Plug's customer support center, allowing the unit to call in overnight to download a data package and an operating status report. However, LOGAN realized very quickly that the system was inadequate and unreliable to provide the high level of communications support needed for its wide-ranging PEM demonstration program. At times a unit called in and provided only partial data or incorrect data. This created uncertainty in troubleshooting and further delay in restoring units to service. On other occasions a unit might fail to call in for a week or more frustrating the normal chain of events leading to a service advisory. While much can be said about the early learning curve experience in developing service norms, the weakness of the SCADA system became a major source of dissatisfaction with Plug Power. Under the circumstances the only means of determining a unit's actual status was to make a service call to the site. However, the scope of LOGAN's PEM program required a better solution. Finally, in March 2003 an event occurred that gave Plug direct insight into the shortcomings of its SCADA system. After advising of a shutdown at Ft Bragg, Plug sent its own technician to the site because LOGAN's technicians were servicing other units. The technician flew from Albany, NY to Raleigh, NC and then drove out to the site. Upon arriving, the technician discovered that the unit was operating normally. Indeed the SCADA system was not.

This event was an important turning point for the LOGAN/Plug Power relationship and its cooperative efforts in achieving the goals of the PEM Demonstration Program. Six weeks later in early June, six representatives from LOGAN and eight from Plug Power met in Atlanta for two days of forthright discussions. The meeting focused on short-term methods and longer term solutions to improve remote PEM fuel cell performance. Most significantly Plug determined that it would institute immediate software changes and upgrades to insure the accuracy of fuel cell data communications. Plug also promised to initiate a design change to its SCADA system that would permit bi-directional remote communications with the fuel cell controller. More importantly Plug promised that LOGAN's technicians would be able to remotely troubleshoot, change set points and attempt restarts under some circumstances. Lastly they also promised that they would publish a daily status report covering all of LOGAN's units. By early August Plug began sending daily status reports, and by mid September Plug shipped LOGAN's technician's new control software that permits remote diagnostics, monitoring, troubleshooting, and restart capabilities. Since the introduction of this new service capability along with the adoption of improved service techniques to go with it, fleet performance, availability and operating costs have begun to show positive new trends.

An Ultralite Logger pictured above in Figure 6 records and stores inputs from the wattmeter, gas meter, Btu meter and an ambient temperature probe. A phone connection to the unit permits remote data retrieval. However, LOGAN has a mounting dissatisfaction with the data retrieval/storage system currently in use at this site and others. The package at this site and others lacks the level of reliability desired for the Program. Future sites will need to employ a more dependable and advanced technology, and provide real time asset management and alarming features.

12.0 Fuel Supply System

LOGAN connected the fuel cell gas piping with the existing gas service conveniently located adjacent to the fuel cell pad, as indicated in the photo in Figure 8 below. A regulator at the fuel cell gas inlet maintains the correct operating pressure at 10-14 inches water column. The photo shows the other components in the fuel train including the gas meter and regulator. It also shows the thermal recovery fluid supply and return lines running between the fuel cell and the thermal storage tank located within the adjacent mechanical room seen in Figure 5.

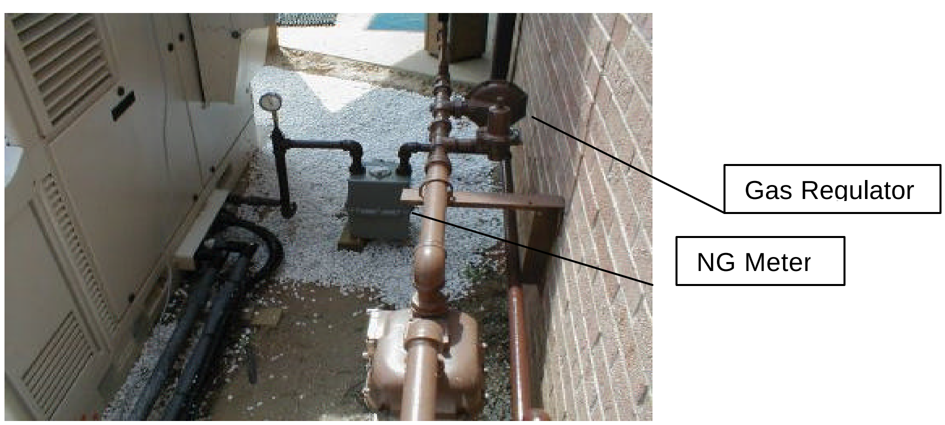


Figure 8

13.0 Installation Costs

Robins AFB PEM Demonstration Program				
Project Utility Rates				
1) Water (per 1,000 gallons)		$ -		
2) Utility (per KWH)		$ 0.039		
3) Natural Gas (per MCF)		$ 7.30		
First Cost			**Estimated**	**Actual**
Plug Power 5 kW SU-1			$ 65,000.00	$ 65,000.00
Shipping			$ 1,800.00	$ 600.00
Installation electrical			$ 1,250.00	$ 1,250.00
Installation mechanical & thermal			$ 3,200.00	$ 2,950.00
Watt Meter, Instrumentation, Logger			$ 3,150.00	$ 3,251.00
Site Prep, labor materials			$ 925.00	$ 432.00
Technical Supervision/Start-up			$ 8,500.00	$ 13,680.00
Total			**$ 83,825.00**	**$ 87,163.00**
Assume Five Year Simple Payback			$ 16,765.00	$ 17,432.60
Forcast Operating Expenses	Volume	$/Hr	$/ Yr	
Natural Gas Mcf/ hr @ 2.5kW	0.0328	$ 0.24	$ 1,889.93	
Water Gallons per Year	14,016		$ -	
Total Annual Operating Cost				$ 1,889.93
Economic Summary				
Forcast Annual kWH		19710		
Annual Cost of Operating Power Plant		$ 0.096	kWH	
Est Credit Annual Thermal Recovery		$ (0.018)	kWH	
Project Net Operating Cost		$ 0.078	kWH	
Displaced Utility cost		$ 0.039	kWH	
Energy Savings (Increase)		($0.039)	kWH	
Annual Energy Savings (Increase)		($767.12)		

Explanation of Calculations:

Actual First Cost Total is a *sum* of all the listed first cost components.
Assumed Five Year Simple Payback is the Estimated First Cost Total *divided by* 5 years.
Forecast Operating Expenses:

At 2.5 kW the fuel cell consumes 0.033 Mcf per hour. The cost per hour is 0.033 Mcf per hour *x* the cost of natural gas $7.30/MCF at Robins. The cost per year at $1892.16 is the cost per hour at $0.24 *x* 8760 hours per year *x* 0.9. The 0.9 is for 90% availability.

Natural gas fuel cell systems set at 2.5 kW will consume 1.6 gallons of water per hour through the DI panel. The total volume of water consumed at 14,016 gallons per year is 1.6 gph *x* 8760 hours per year. There is no cost for water for the system as water is provided from wells at the base at no charge.

The Total Annual Operating Cost, $1892.16 is the *sum of* the cost per year for the natural gas and the cost per year for the water consumption.

Economic Summary:

The Forecast Annual kWh at 19,710 kWh is the product of 2.5 kW set point for the fuel cell system *x* 8760 hours per year *x* 0.9. The 0.9 is for 90% availability.

The calculated Cost of Operating the Power Plant equals $0.096 per kWH; that is the Total Operating Cost of $1892.16 *divided* by the forecast annual kWh at 19,710 kWh.

The Credit for Annual Thermal Recovery of $0.018/kWH equals 7800 BTU per hour thermal recovery at 2.5 kW *divided* by 3414BTU/kwH *multiplied* .20 recovery factor, *multiplied* by $0.039/kWh. As a credit to the cost summary, the value is expressed as a negative number.

The Project Net Operating Cost is the *sum* of the Annual Cost of Operating the Power Plant *plus* the Credit Annual Thermal Recovery.

The Displaced Utility Cost is the kWh cost of electricity to Robins.

Energy Savings (Increase) equals the Displaced Utility Cost (*plus)* or *minus* the Project Net Operating Cost.

Annual Energy Savings (Increase) equals the Energy Savings (**Increase**) *times* the Forecast Annual kWh.

14.0 Acceptance Test

An 8-hour acceptance test was run on April 24, 2003 by the technician. It was the first successful start-up of the system. The hours allotted for each task in the report are standard and routine. Please see Appendix 2 for documentation of the test done by the technician.

Appendix

1) Monthly Performance Data

2) Acceptance Test Logs

3) Daily Work Logs

Appendix

1) Monthly Performance Data

onthly Performance Data

obins AFB

	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04	Feb-
un Time (Hours)	174.27	381.74	963.02	1683.02	2282.6	2834.74	3035.74	3166.74	3740.
me in Period (Hours)	288	1032	1776	2496	3240	3960	4704	5448	61
vailability (%)	60.5%	37.0%	54.2%	67.4%	70.5%	71.6%	64.5%	58.1%	60.
nergy Produced (kWe-hrs AC)	413.9	971.5	2,463.4	4,272.4	5,764.4	7,121.4	7,617.4	7,907.4	9,29
utput Setting (kW)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.
verage Output (kW)	2.38	2.54	2.56	2.54	2.53	2.51	2.51	2.50	2.
apacity Factor (%)	28.7%	18.8%	27.7%	34.2%	35.6%	36.0%	32.4%	29.0%	30.
uel Usage, HHV (BTUs)	4,731,454.5	11,604,519	29,997,826	53,890,015	73,549,720	91,098,830	98,105,031	102,375,832	116,532,9
uel Usage (SCF)	4,677.5	11,472.2	29,655.9	53,275.7	72,711.3	90,060.3	96,986.6	101,208.7	115,20
ectrical Efficiency (%)	29.9%	28.6%	28.0%	27.1%	26.8%	26.7%	26.5%	26.4%	27.
hermal Heat Recovery (BTUs)	2,781,349	1,700,252	2,429,543	3,098,861	3,305,712	-	-	-	
leat Recovery Rate (BTU/H)	6384	6384	6223	6383	6517	0	0	0.00	0.
hermal Efficiency (%)	-	25%	13%	13%	17%	0%	0%	0%	(
verall Efficiency (%)	29.9%	53.3%	41.2%	40.0%	43.6%	26.7%	26.5%	26.4%	27.
umber of Scheduled Outages	0	0	0	0	0	0	0	1	
cheduled Outage Hours	0	0	0	0	0	0	0	613	6
umber of Unsched Outages	1	2	3	3	4	5	7	7	
nscheduled Outage Hours	114	651	814	814	958	1126	1669	1669	17

2) Installation and Acceptance Test

Site: Robins AFAB...SU01-192

Installation Check List

TASK	Initials	DATE	TIME (hrs)
Batteries Installed	KW	4/3/03	2
Stack Installed	KW	4/3/03	3
Stack Coolant Installed	KW	4/3/03	1
Air Purged from Stack Coolant	KW	4/3/03	0.5
Radiator Coolant Installed	KW	4/3/03	2
Air Purged from Radiator Coolant	KW	4/4/03	1
J3 Cable Installed	KW	4/4/03	1
J3 Cable Wiring Tested	KW	4/3/04	0.5
Inverter Power Cable Installed	KW	4/3/04	0.5
Inverter Power Polarity Correct	KW	4/3/04	0.5
RS 232 /Modem Cable Installed	KW	4/3/04	0.5
Natural Gas Pipe Installed	KW	3/25/03	8
DI Water / Heat Trace Installed	KW	4/4/03	4
Drain Tubing Installed	KW	4/4/03	1

Commissioning Check List and Acceptance Test

TASK	Initials	DATE	TIME (hrs)
Controls Powered Up and Communication OK	KW	4/21/03	4
SARC Name Correct	KW	4/21/03	1
Start-Up Initiated	KW	4/22/03	6
Coolant Leak Checked	KW	4/22/03	1
Flammable Gas Leak Checked	KW	4/22/03	1
Data Logging to Central Computer	KW	6/19/03	1
System Run for 8 Hours with No Failures	KW	4/24/03	8

3) Daily Work Logs

Daily work log for Keith Williams
LOGANEnergy Field Technician
February 1, 2003 through July 24, 2003

Date	Activity	Hours
2/1/03	Drove to Robins from Columbia, South Carolina to get project started	3
2/2/03	At Robins all day	
2/3/03	Met with Lt. Muldoon and reviewed sites - Fire Station looks good	6
2/11/03	Met with group from Robins and Dr. Binder and selected fire station as site	10
2/17/03	Ordered parts for installation and talked with contactors	5
3/10/03	Flew to Robbins to meet with contractors	7
3/18/03	Worked at assembling parts for CHP pre-fab	6
3/19/03	Started the pre-fab still missing a few key parts	8
3/20/03	Finished the pre-fab of water storage tank and started data logging fabrication	8
3/21/03	Finished data logging fabrication	6
4/1/03	Drove to Robins met with contractor unloaded CHP parts	12
4/2/03	Worked with contractors to install fuel cell	10
4/3/03	Installed cell stack, filled fluids and charged batteries and started wiring of CHP	10
4/4/03	Finished r/o installation and wiring for CHP need cable for inverter	10
4/21/03	Drove to Robins and attempted to put inverter into mode 3	12
4/22/03	Unsuccessful day of trying to install software for inverter. I thought it was good but p/p would not progress beyond 3 DCL. I am sending current setpoints to PLUG	8
4/23/03	I Thought inverter problems are over but after 3 start attempts something is still not right. I can get to 15 dcl now but no more	10

	sending data to PLUG	
4/24/03	I met with Sam and Chris and gave start up another go p/p started it appears the problem is the contactor in the inverter needed to be exercised by opening and closing the main breaker. I brought power up to 4kw for a couple of hours and then to 5kW for a couple more while that was going on I worked on the dial out for the modem to no avail left with power at 2.5kw	11
6/2/03	I drove to site to troubleshoot shutdown. Power plant wouldn't power up. I replaced SARC and installed new 1.23 software	14
6/3/03	More troubleshooting. The problem looks inverter related. Plug is sending a new chip with setpoints. Waiting for parts	16
6/4/03	Parts not available. Drove home	7
6/9/03	I drove to site to install new chip and jumper but couldn't load setpoints.	15
6/10/03	I needed a laptop with Win98 to load setpoints. Once that was done I was still having problems with the inverter	10
6/11/03	I continued to troubleshoot inverter problems and decided to start the p/p and it worked. The problem was inverter was reading critical loads	9
6/19/03	Drove to site to troubleshoot shutdown. Installed new modem software. It worked. I replaced r/o and carbon filters started p/p	21
7/24/03	System down for a week but did not know it till 5 days after shutdown. Low battery alerts while operating signaled the need for new batteries. When system went down, the batteries took two days to bleed down to 36V and killed the system which sent the inverter out of mode 3 thereby shutting down the critical load. Employees threw the bypass switch. There were many glitches that took 5 starts to overcome. Still don't know why it shut down last week, but it does need new batteries.	13

August-03
Robins AFB

Date	PP S/N	Activity	Hours
8/11/03	S/N192	Drove to Robins to t/s shutdown	9
8/12/03		Repaired inverter and it appeared to be working fine restarted p/p drove home	16

Oct-03
Robins AFB

Date	PP S/N	Activity	Hours
10/20/03	S/N192	Drove to site and restarted the p/p drove home	21

Nov-03
Robins AFB

Date	PP S/N	Activity	Hours
11/10/03	SU192	Site Monitoring - Collected Data.	8
11/11/03			7
11/26/03		Running	

Jan-04

Robins AFB	PP S/N	Activity	Hours
1/20/04		Drove to site	8
1/21/04	192	Loaded v1.28 software and enabled grid charging. Changed sediment filter and carbon filter.	8
1/22/04	192	Installed new batteries and restarted fuel cell.	7
1/23/04		Drove home	8
1/28/04	192	Changed RO filter and restarted.	10

Feb-04
Robins AFB

Date	PP S/N	Summary/Milestones	Hours
02/06/04	192	Started the p/p remotely; cell 88 was low. Unsuccessful in collecting data. After a warm up, tried to connect but unsuccessful. Successful connection with old laptop. P/p had E-Stopped with "loss of inverter com" at 6:40pm est.	4
02/12/04		Had Julian power down /power up the p/p and restarted the p/p remotely. Shutdown was due to gas curtailment	4
02/19/04		System Status: Running	